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EXAMINER	
FULK, STEVEN J	
ART UNIT	PAPER NUMBER
2891	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/27/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS . from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/689,167	BUSTA, HEINZ H.	
	Examiner	Art Unit	
	Steven J. Fulk	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6,10-40 and 42-57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6,10-39,42-55 and 57* is/are rejected.

7)☒ Claim(s) *40 and 56* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed October 10, 2006, which amends claims 28 and 42, has been entered. Claims 1-3, 6, 10-40 and 42-57 are currently pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 11, 14-19 and 27-28 are rejected under 35 U.S.C. 102(b) as being anticipated by De Los Santos et al. '611.

a. Regarding claims 11, 14-16 and 27, De Los Santos et al. discloses a MEM device comprising a moveable mechanism (fig. 2, 28) residing adjacent a substrate (22); an abrasion resistant material localized on a first portion of the movable mechanism (30b; col. 6, lines 62-65; contact contains TiW, an art recognized abrasion resistant material); a first contact region localized on the substrate that attracts the moveable mechanism toward the substrate (40b) such that the abrasion resistant material becomes operationally coupled to a second contact region (24b) comprising an abrasion resistive

material that resides on the substrate, wherein the second contact material is similar to the first portion material (24b also contains TiW; col. 5, lines 24-26).

b. Regarding claims 17-18, the reference discloses the second contact region to comprise a first RF contact portion and a second RF contact portion, such that the movable mechanism shorts the first and second RF contacts (fig. 7, 24b; RF IN & OUT); and a third contact region operable to pull back the moveable mechanism from being attracted to the second contact region (fig. 2, 38a).

c. Regarding claim 19, the reference further discloses the moveable mechanism to comprise a first anchor portion (fig. 2, 34) and a second anchor portion (32) integral to a top surface of the substrate.

d. Regarding claim 28 and insofar as definite, the reference further discloses a dielectric layer (fig. 17, 64) deposited along the surface of the substrate such that when the first contact region is energized, the moveable mechanism (60) is not physically coupled to the second contact region (64 covers second contact 54 from being engaged with mechanism 60).

4. Claims 11-17 and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Ma et al. '022.

a. Regarding claims 11-12, 14 and 27, Ma et al. discloses a MEM device comprising a movable mechanism (fig. 12, 370A) residing adjacent a substrate (310); a diamond abrasion resistant material (fig. 19, coating 350) localized on a first portion of the movable mechanism (fig. 12, contact 365);

and a first contact region localized on the substrate (fig. 12, 320B) used to attract the movable mechanism towards the substrate such that the abrasion resistant material becomes operationally coupled to a second contact region (320C) residing on the substrate.

b. Regarding claim 13, the reference discloses the abrasion resistant material to be disposed along the first portion of the movable mechanism, the first portion subject to abrasion as the abrasion resistant material becomes operationally coupled to the second contact region (col. 3, lines 57-65; col. 4, lines 63-67; contact 365 is coated with diamond layer 350 to prevent wear).

c. Regarding claim 15-16, the reference discloses second contact region comprises an abrasion resistive material similar to the abrasion resistive material localized on a portion of the movable mechanism (Abstract, multiple contact surfaces coated with diamond; fig. 1, second contact region 120C coated with diamond layer 140C).

d. Regarding claim 17, the reference discloses second contact region comprises a first RF contact portion and a second RF contact portion such that when the movable mechanism is attracted towards the substrate, the abrasion resistive material shorts the first RF contact portion and second RF contact portion (col. 1, lines 11-17, RF switch device; col. 3, lines 57-65, contact 365 shorts to 320C).

5. Claims 39, 42-50, 52-55 and 57 are rejected under 35 U.S.C. 102(e) as being anticipated by Ruan et al. '602.

a. Regarding claims 39, 48 and 50, Ruan et al. discloses an integral micro-machined structure (fig. 5) for enclosing a MEM device (112) comprising a structure (512) extending from a substrate (102) and enclosing the MEM device; and a cover structure extending on a portion of the substrate structure (506), a contact region (508) provided on the cover substrate structure and acting as a pull-back contact for a MEM device residing on the substrate, wherein the micro-machined structure defines a tortuous, labyrinth path (114; fig 1B, 114 is shown to have a labyrinth channel structure).

b. Regarding claim 42, the reference discloses a shielding member which prevents passage of electromagnetic radiation(504/506;insulating substrate).

c. Regarding claim 43, the reference discloses a sealing member that engages the tortuous path and seals the enclosure (506 seals enclosure 116 and engages tortuous channel 114).

d. Regarding claims 44-47, the reference discloses an inert, arch preventing gas (air) or vacuum provided in the sealed enclosure (col. 4, lines 26-30).

e. Regarding claim 49, the reference discloses a second MEM enclosed by the micro-machined structure (arrays of devices are formed; col. 3, lines 2-4).

f. Regarding claims 52-54 and 57, Ruan et al. discloses a method of fabricating a micro-machined structure for enclosing a MEM device (fig. 5, 112) comprising providing a substrate (fig. 5, 102); fabricating a vertical

substrate structure (512) extending from the substrate; and fabricating a cover substrate structure (506) residing on a portion of the substrate structure and defining a tortuous, labyrinth channel (114; fig 1B, 114 is shown to have a labyrinth channel structure).

g. Regarding claim 55, the reference discloses the step of enclosing a plurality of MEM devices in the micro-machined apparatus (arrays of devices are formed; col. 3, lines 2-4).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-3, 6 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Daneman et al. '887 in view of Lin et al. (NPL Reference "U", previously provided).

Daneman et al. discloses a MEM device comprising a movable micro-machined structure comprising a lever mechanism (fig. 9A, 911), with a conductive diamond material defining an abrasion resistive contact area (diamond is art recognized as the hardest material on Mohs scale, and therefore an inherent abrasion resistive material) disposed along a surface of the structure (922-928; col. 11, lines 12-17). The reference also discloses the device to operate as a switch or relay (col. 1, lines 35-38; optical switch that relays signals from one fiber to

another); and the invention to further comprise an integral enclosure that encloses the movable micro-machined structure (fig. 10A-10F, insulating layer 1010 and conductive layer 1014 enclose device layer 1002). The device is inherently subject to abrasion as it closes.

Daneman et al. does not disclose the movable lever mechanism to comprise a rib enforced lever mechanism. Lin et al. discloses a movable micro-machined structure comprising a rib enforced lever mechanism (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced lever of Lin et al. in the switch mechanism of Daneman et al. One would have been motivated to do this because Lin et al. taught that the standard levers used to support mirrors in optoelectronic switches, such as the switch of Daneman et al. (fig. 9A, 913), become deformed under electrostatic forces, and using a rib enforced lever reduces this deformation (Lin et al., page 93, section 1), thus extending the lifetime of the device.

8. Claims 20-23, 29-31, 34-36 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"). The process limitations of planarization found in claims 22, 23 and 36 invoke the product-by-process doctrine. Product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps (*MPEP § 2113*). For example, anticipation of claims 22, 23 and 36 does not require the surface to be processed using a CMP step; anticipation only requires that the layer has a planar surface.

De Los Santos et al. discloses all of the elements of the claims as set forth in paragraph 3 above, including a planar metallic (conductive composition) surface (fig. 2, contact 30b) and first and second micro-strip contact lines (fig. 7, 24b; RF IN & OUT), but the reference does not disclose the surface to define an integral rib. Lin et al. discloses a movable mechanism with a second surface defining an integral rib. (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced mechanism of Lin et al. in the switch mechanism of De Los Santos et al. One would have been motivated to do this because Lin et al. taught that the standard levers used in switches become deformed under electrostatic forces, such as the forces applied by De Los Santos to operate the switch (col. 4, lines 41-47), and using a rib enforced lever reduces this deformation, thus improving the performance of the device (Lin et al., page 93, section 1).

9. Claims 24-26 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"), and further in view of Daneman et al. '887.

a. Regarding claims 24-26, De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as set forth in paragraph 8 above, including a pull-back contact on the substrate of the device (fig. 2, 38a), but the references do not explicitly teach an integral enclosure that electrically shields and encloses the MEM device. Daneman et al. teaches a MEM device comprising a movable micro-machined structure with an integral enclosure

that electrically shields and encloses the MEM device (fig. 10A-10F, electrically shielding insulating layer 1010 and conductive layer 1014 enclose device layer 1002).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the integral enclosure of Daneman et al. in the device as described by De Los Santos et al. in view of Lin et al. One would have been motivated to do this because it was well known in the art that the insulating enclosure would have both reduced the switch's susceptibility to electrical noise and protected it from environmental conditions, such as moisture and contamination, thus improving the performance of the device.

b. Regarding claim 33, De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as set forth in paragraph 8 above, including a conductive layer, but the references do not teach the conductive layer to comprise diamond. Daneman et al. teaches a MEM device comprising a movable mechanism with a conductive diamond material on the mechanism (fig. 9A; col. 11, lines 12-17).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond material of Daneman et al. in the MEM device as described by De Los Santos et al. in view of Lin et al. One would have been motivated to do this because diamond was well known in the art as the hardest material on Mohs scale, and thus would have

improved the abrasion resistance of the contact and extended the lifetime of the device.

10. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"), and further in view of Ruan et al. '880.

De Los Santos et al. in view of Lin et al. teaches all of the elements of the claims as set forth in paragraph 8 above, including a conductive layer, but the references do not teach the conductive layer to comprise copper. Ruan et al. teaches a MEM device comprising a movable mechanism with a conductive copper material on the mechanism (fig. 1A, 120; ¶26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the copper material of Ruan et al. in the MEM device as described by De Los Santos et al. in view of Lin et al. One would have been motivated to do this because Ruan et al. taught that copper was an art recognized functional equivalent to the gold containing conductive layer of De Los Santos et al. (Ruan et al., ¶26).

11. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Daneman et al. '887.

De Los Santos et al. discloses all of the elements of the claim as set forth above in paragraph 3, but the reference does not explicitly teach an integral enclosure that encloses the MEM device. Daneman et al. teaches a MEM device comprising a movable micro-machined structure with an integral enclosure that

electrically shields and encloses the MEM device (fig. 10A-10F, electrically shielding insulating layer 1010 and conductive layer 1014 enclose device layer 1002).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the integral enclosure of Daneman et al. in the device of De Los Santos et al. One would have been motivated to do this because it was well known in the art that the insulating enclosure would have both reduced the switch's susceptibility to electrical noise and protected it from environmental conditions, such as moisture and contamination, thus improving the performance of the device.

12. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ruan et al. '602 in view of Clevenger et al. '526.

Ruan et al. discloses all of the elements of the claim as set forth in paragraph 5 above, but the reference does not explicitly teach the structure for enclosing the device to comprise diamond. Clevenger et al. teaches a method of forming a microelectronic device having an enclosing cap comprising diamond (fig. 9, 19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond material of Clevenger et al. in the enclosing cap of Ruan et al. One would have been motivated to do this because a diamond cap would have provided improved thermal conductivity over the material of Ruan et al. (Clevenger et al., ¶43), thus allowing heat generated by the device to dissipate thereby increasing the lifetime of the device.

Response to Arguments

13. Applicant has amended claims 36 and 42 to overcome the rejections set for under 35 U.S.C. 112, second paragraph. Therefore, the 35 U.S.C. 112, second paragraph rejections have been withdrawn.

14. Applicant's arguments with respect to the rejection of claims 11, 14-19 and 27-28 have been fully considered but they are not persuasive. Applicant argues that the contact pads of De Los Santos et al. do not contain an abrasive resistant material. However, the Applicant agrees that the contact pads are formed of TiW-Au (Arguments, page 9, line 12, TiW-Au layer is formed into separate first and second contacts), and therefore contain an abrasive resistant material. The TiW layer under the gold layer of the lever contact would be in electrical contact with the substrate contract, and therefore the TiW material is in operational contact as required by claim 11.

15. Applicant's arguments with respect to the rejection(s) of claim(s) 13 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Ma et al. '022 as set forth above.

16. Applicant's arguments with respect to the rejection of claims 39, 42-50,52-55 and 57 have been fully considered but they are not persuasive. Applicant argues that Ruan et al. does not disclose a cover structure extending on a portion of a substrate structure, but rather discloses two substrates separated by spacers. The second substrate disclosed by Ruan et al. functions as a cover structure extending on a portion of a substrate structure, and therefore anticipates the structure described by claim 39.

17. Applicant's arguments with respect to the rejection of claims 1-3, 6 and 10 have been fully considered but they are not persuasive. Applicant argues that the terms arm and beam do not read on the term lever, and therefore the rib design used to stiffen an arm or beam would not work in a lever mechanism. However, the Applicant uses the terms beam, lever and arm interchangeably in the Specification. In the Background of the Specification, numerous references are made to "cantilever beams" (page 4, paragraph 5), and "cantilevers" later described as "beams" (pages 4-5, paragraph 6). Applicant also uses the terms "arm lever" and "cantilever beam" through the Description (i.e., page 12, paragraphs 44-46). Therefore, the terms lever, arm and beam are defined by the Applicant to be functional equivalents, as is conventional in the art. Further, the motivation to enhance a lever with a rib design, as taught by Lin et al., is valid to extend the lifetime of the switch.

18. Applicant's arguments with respect to the rejection of claim 37 have been fully considered but they are not persuasive. Applicant argues that De Los Santos et al. does not teach all the limitations of the claims as asserted in the Office Action. This argument was not found persuasive, as described in paragraph 14 above. It is the examiner's position that the combination of De Los Santos et al. in view of Daneman et al. teaches all of the limitations of the claims. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

19. Applicant's arguments with respect to the rejection of claim 20-23, 29-31, 34-36 and 38 have been fully considered but they are not persuasive. Applicant argues that De Los Santos et al. does not teach all the limitations of the claims as asserted in the Office Action. This argument was not found persuasive, as described in paragraph 14 above. Applicant also argues that there is no motivation to modify a lever design to include a rib. This argument was also not found persuasive, as described in paragraph 17 above.

20. Applicant's arguments with respect to the rejection of claim 24-26 and 33 have been fully considered but they are not persuasive. Applicant argues that there would be no motivation to combine the integral enclosure of Daneman et al. with the device as described by De Los Santos et al. in view of Lin et al. because neither the De Los Santos nor the Lin reference teach that electrical noise or environmental conditions are a problem with semiconductor devices. However, it was the Examiner's position that using integral enclosures to insulate semiconductor devices from electrical noise and environmental conditions is conventional and necessary for the devices to perform their intended function, and would it be obvious to one of ordinary skill in the art to employ such an enclosure.

Applicant also argues that De Los Santos does not provide motivation for using an abrasion resistant conductive diamond layer to improve switch contacts. However, it was the Examiner's position that contact wear was a well known problem in MEM switches, and that using conductive abrasion layers to extend the lifetime of the switch would have obvious to one of ordinary skill in the art. Ma et al. '022 provides further evidence that the wear-down of contacts in switches is a

well known problem that is solved by conductive abrasion resistant coatings (Ma et al, col. 1 lines 11-17; col. 3, lines 57-65; col. 4, lines 63-67)

21. Applicant's arguments with respect to the rejection of claim 32 have been fully considered but they are not persuasive. Applicant argues that there is no incentive to substitute copper for gold in the conductive rib layer, and therefore it would not be obvious. However, MPEP § 2144.06 states that it is indeed obvious to substitute functional equivalents for the same purpose, as long as the prior art recognizes the equivalency. Ruan et al. '880 states that the cantilever can be made from gold or copper, thus recognizing the equivalency of the metals.

22. Applicant's arguments with respect to the rejection of claim 51 have been fully considered but they are not persuasive. Applicant argues that Ruan et al. does not teach all the limitations of the claims as asserted in the Office Action. This argument was not found persuasive, as described in paragraph 16 above. Applicant also argues that Ruan et al. provides no motivation for the desirability of an enclosure having high thermal conductivity. However, the motivation for having high thermal conductivity was provided by Clevenger et al. (¶43), and it is also well known in the art that conducting heat away from a semiconductor device is necessary to ensure proper functionality of the device.

Allowable Subject Matter

23. Claims 40 and 56 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, as previously indicated.

Conclusion

24. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571) 272-8323. The examiner can normally be reached on Monday through Friday, 9:30am to 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

25. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SJF

Steven J. Fulk
Patent Examiner
Art Unit 2891

December 15, 2006

BRADLEY K. SMITH
PRIMARY EXAMINER